Fraser Thomas
ENGINEERS • RESOURCE MANAGERS • SURVEYORS

18 February 2021 CH00417

Selwyn District Council
PO Box 90
Rolleston

Attention: Ms Rachel Carruthers

Dear Madam,

PC200072: TRICES ROAD REZONING GROUP PRIVATE PLAN CHANGE- RESPONSE TO REQUEST FOR FURTHER INFORMATION

This letter has been prepared in response to a letter, sent by Selwyn District Council (SDC), dated 2 February 2021, requesting further information relating to a submission on the Proposed Selwyn District Plan, and a private plan change request to the Operative Selwyn District Plan, seeking rezoning of Trices Road properties from "Rural" to "Residential".

Fraser Thomas previously prepared a Geotechnical Investigation Report, dated 10 November 2020, for the subject site, in support of a submission on the Proposed Selwyn District Plan, for a private plan change.

The SDC letter has requested further clarification on six geotechnical matters, identified as Items 20, 21, 22, 23, 24 and 25. This letter addresses those items.

Item 20- Matters relating to the site's past performance

Item 20 of the SDC letter, requests:

> **"The mean peak ground accelerations from the Bradley & Hughes model are set out in Table 1. Please advise how these relate to SLS and ULS levels of shaking and if the site has been "sufficiently tested" at SLS (MBIE 13.5.1), as past performances has been used to partially justify the TC1 classification."**

The primary justification for our determination that the subject site should be assumed to be within Foundation Technical Category 1 (TC1), as defined by the MBIE guidance documents, is summarised below:

(1) the results of the theoretical analyses, presented in the November 2020 geotechnical report, which indicates that the surficial soils are not expected to liquefy under the SLS or ULS design earthquake events,

FRASER THOMAS LIMITED
P.O. BOX 39 154,
HAREWOOD POST CENTRE,
CHRISTCHURCH 8545, NEW ZEALAND
PHONE: +64 3 358 5936
FAX: +64 3 358 5936
www.fraserthomas.co.nz

(2) the nature of the upper soils underlying the site, i.e. generally dense to very dense gravel soils,

(3) the depth to groundwater (expected to be no shallower than 2.5 m).

The observed performance of the site in response to seismic loading imposed by the 2010/2011 Canterbury earthquake sequence provides some validation of the results of our theoretical assessment, but is not the primary justification for the TC1 classification.

Nevertheless, The NZGD indicates the following conditional median peak ground accelerations were likely experienced at the site, during the 20201/2011 Canterbury earthquake sequence:

Earthquake Event	**Likely Peak Ground Accelerations (pga) (proportion of gravity acceleration (m/s^2))**
September 2010	0.35g
February 2011	0.25g
June 2011	0.11g

When these values are adjusted, using the recommended Magnitude Scaling Factor (MSF), it is evident that the September 2010 earthquake event likely imposed an equivalent design earthquake event (pga) of approximately 0.32g at the subject site (0.35g x 0.90 (MSF)).

A pga value of 0.32g is significantly higher than the SLS design earthquake loading of 0.13g, and the subject site is therefore considered to have been "sufficiently tested" under SLS design earthquake load conditions.

It should also be noted that a pga value of 0.32g is approaching the ULS design earthquake loading of 0.35g, and is therefore considered to also provide a good predictor as to the likely performance of the site under future ULS loading conditions.

Item 21- NZGD test data

Item 21 of the SDC letter, requests:

> **"Please supply the test data from the NZGD (location and logs) used to help identify the soil profile (8.3)."**

The logs of the existing machine excavated test pits, put down by other consultants, which have been sourced from the NZGD, are appended to this letter.

The test pits are located at a site abutting the western site boundary. The approximate inferred location and extent of these test pits are shown on the appended Fraser Thomas Ltd drawing G00417-02.

Item 22- ECan water bore logs

Item 22 of the SDC letter, requests:

> **"Please supply the Ecan well logs and locations used to model the gravels as extending to 18m depth (8.3)."**

The logs of the relevant existing water bore logs, sourced from ECan records, are appended to this letter.

The approximate inferred location and extent of the relevant water bores are shown on the appended Fraser Thomas Ltd drawing G00417-02.

Item 23- Deep testing density

Item 23 of the SDC letter, requests:

> **"Please confirm that the number of tests either on site or close by, do adequately meet the intent of the MBIE Guidance (16.2) to adequately characterize the soils to at least 5m depth in terms of density and depth (MBIE 6.3)."**

The MBIE guidelines "Repairing and rebuilding houses affected by the Canterbury earthquakes", provides some suggested minimum investigation density guidelines for "deep investigations". The guidelines suggest, for a plan change, a minimum of 5 deep tests (with a suggested range of 0.2 to 0.5 tests per hectare).

The subsoil information presented in the Fraser Thomas report, dated November 2020, has been determined using the following geotechnical field investigation tests:

(1) Eight hand augered boreholes

(2) five CPT probes

(3) four water bores (18 in total within close proximity to the site)

(4) two machine excavated test pits.

CPT probes are generally considered to be "deep investigation" tests, although, due to the nature of the subsoils underlying the site, the CPT probes were unable to be progressed deeper than approximately 3.8 m below the existing ground surface.

The water bores and machine excavated test pits (approximately 4.0 m deep), however, should be considered to be "deep investigations". There are 18 water bores within, or in close proximity to, the site, which vary in depth between approximately 6 m and 36 m below the existing ground surface. We have only presented the logs for some of the deeper water bores and for the water bores spatially separated across the site, so as to provide for a good site coverage, in order to demonstrate the consistency of the gravel soils across the site.

If you include the data provided by the existing machine excavated test pits, and all of the existing water bores, a total of 20 "deep" test locations have been sourced for the determination of the subsoil conditions at the site, which exceeds the minimum suggested by the MBIE guidelines for Plan change purposes. That been said, it should be noted that the MBIE guidelines were issued as "guidance" under Section 175 of the Building Act 2004, so the suggestions/methods provided in the guidelines are not considered to be mandatory. It is our opinion that the nature and extent of geotechnical investigation works should be determined by an appropriately qualified and experienced CPEng (Geotechnical) Engineer, and should be developed by assessing the geological conditions, determining the likely geotechnical hazards affecting the subject site, and should be cognitive of the nature of the proposed development.

Given the nature of the subsoils underlying the site, i.e generally dense to very dense gravel soils encountered at shallow depths, the type and the quantum of "deep investigation" undertaken for the site, for the purposes of determining the nature and consistency of the subsoils for a Plan change, is considered to be adequate.

It should be noted, should the site be rezoned and a concept subdivision be proposed, that Fraser Thomas would be required to prepare a Geotechnical Investigation Report, in support of an application for the proposed subdivision. It is envisaged that additional field investigations would be undertaken for this "subdivision" geotechnical report, in order to provide more information relating to the nature and consistency of the subsoils and the groundwater depths, which would likely include:

(a) 2 sonic machine boreholes (with standpipe piezometers installed)- 10 m to 15 m deep

(b) 6 machine excavated test pits.

Item 24- Groundwater depth

Item 24 of the SDC letter, requests:

"Please supply the data from which the groundwater depth has been derived"

No groundwater was encountered at the locations of the CPT probes, the hand augered boreholes or the machine excavated test pits (abutting the western site boundary). This would indicate that the groundwater level underlying the site is likely to be greater than 4.0 m depth. I believe that one of the water bore logs had a recorded groundwater level of 2.5 m depth. Although this depth is not consistent with the groundwater levels encountered at the locations of other test positions across the site (i.e deeper than 4.0 m), we adopted this conservatively shallow groundwater level for analyses purposes.

In reality, it is likely that the groundwater level beneath the site is likely to be deeper than 2.5 m. This will be confirmed by the installation of standpipe piezometers (proposed for the subdivision report).

Item 25- RMA Section 106

Item 25 of the SDC letter, requests:

> **"The RMA section 106 sets out natural hazards which need to be considered before granting subdivision consent. Please supply a natural hazard assessment."**

It should be noted that the Fraser Thomas Ltd report, dated 10 November 2020, has been prepared in support of a submission on the Proposed Selwyn District Plan, for a private plan change, and has not been prepared in support of an application for subdivision consent.

It is our opinion that the "opinion statement" as to the suitability of the subject site for future residential development, is well summarised in Section 19.1(a) of our report, which states:

> *"In general terms and within the limits of the investigation as outlined and reported herein, no unusual problems, from a geotechnical perspective, are anticipated with residential development at the subject site.*
>
> *The site is, in general, considered suitable for its intended use, with satisfactory conditions for future residential building development, subject to the recommendations and qualifications reported herein, and provided the design and inspection of foundations are carried out as would be done under normal circumstances in accordance with the requirements of the relevant New Zealand Standard Codes of Practice."*

Nevertheless, in order to satisfy the peer reviewer's request, we confirm that the Fraser Thomas Ltd geotechnical report, dated 10 November 2020, includes recommendations which will appropriately avoid, remedy or mitigate potential geotechnical hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act (in particular- see Sections 14.0, 15.0, 16.0 and 17.0 of the November 2020 report).

I trust the foregoing satisfies the requirements of SDC.

Kind regards

MASON REED
Director
CPEng (Geotechnical Engineer)

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Machine Excavated Test Pit Logs

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Excavation Log - TP07

100 Birches Road

Prebbleton

Client	: Conifer Grove Trustees Ltd	**Date**	: 31/1/13
Project	: 09875	**Shear Vane No.**	: 1379
Excavation Method	: Test pit	**Logged/Reviewed By**	: RB/CL
Excavator Type	: 6 T	**Latitude**	: -43.5931
Bucket Type	: Toothed	**Longitude**	: 172.5103

Depth (m)	Method	Penetration (0 1 2 3)	Support	Geological Unit	USCS	DESCRIPTION	Graphic Log	Water Level	Moisture Condition	Shear Vane (kPa) Peak/Remolded	Consistency / Density Index	Scala Penetrometer Blows per 100 mm (0 2 4 6 8 10 12)
0.0	EXCAVATION		UNSUPPORTED	TS	ML	SILT with trace rootlets; light brown [TOPSOIL].			D		VSt	
0.3				ALLUVIUM	SP	Fine SAND; greyish brown. Poorly graded. Moderately packed.			D		D	
0.5					GW	Sandy fine to coarse GRAVEL with trace cobbles; greyish brown. Well graded; subrounded gravel; fine to coarse sand; trace tree roots from 0.5 m to 2.5 m depth. Moderately compacted.			D-M		MD-D	
1.6						Becomes moist at 1.6 m depth.			M			
2.8						Trace organic silt encountered from 2.8 m depth.						
3.0						EOH: 3.0 m Termination: target depth Groundwater not encountered. Scala penetrometer terminated at practical refusal. TS = TOPSOIL						
4.0												

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Excavation Log - TP08

100 Birches Road

Prebbleton

Client	: Conifer Grove Trustees Ltd	**Date**	: 31/1/13
Project	: 09875	**Shear Vane No.**	: 1150
Excavation Method	: Test pit	**Logged/Reviewed By**	: CL
Excavator Type	: 6 T	**Latitude**	: -43.5938
Bucket Type	: Toothed	**Longitude**	: 172.5102

Depth (m)	Method	Penetration (0 1 2 3)	Support	Geological Unit	USCS	DESCRIPTION	Graphic Log	Water Level	Moisture Condition	Shear Vane (kPa) Peak/Remolded	Consistency / Density Index	Scala Penetrometer Blows per 100 mm (0 2 4 6 8 10 12)
0.0	EXCAVATION		UNSUPPORTED	TS	TS	SILT with some rootlets; brown.[TOPSOIL]			D	UTP	H	
0.5				ALLUVIUM	ML	SILT with minor rootlets; light yellowish brown. Low plasticity.						
1.0					GW	Sandy fine to coarse GRAVEL; light brown. Well graded, rounded, greywacke gravel; medium to coarse sand. Tightly packed, minor undercut due to dislodging cobbles from the pit walls.			M		D	
1.5						Trace cobbles from 1m.						
2.0												
2.5												
3.0						EOH 3.0m Target depth. Groundwater not encountered. Scala penetrometer met refusal, bouncing on gravel. TS = TOPSOIL						
3.5												
4.0												

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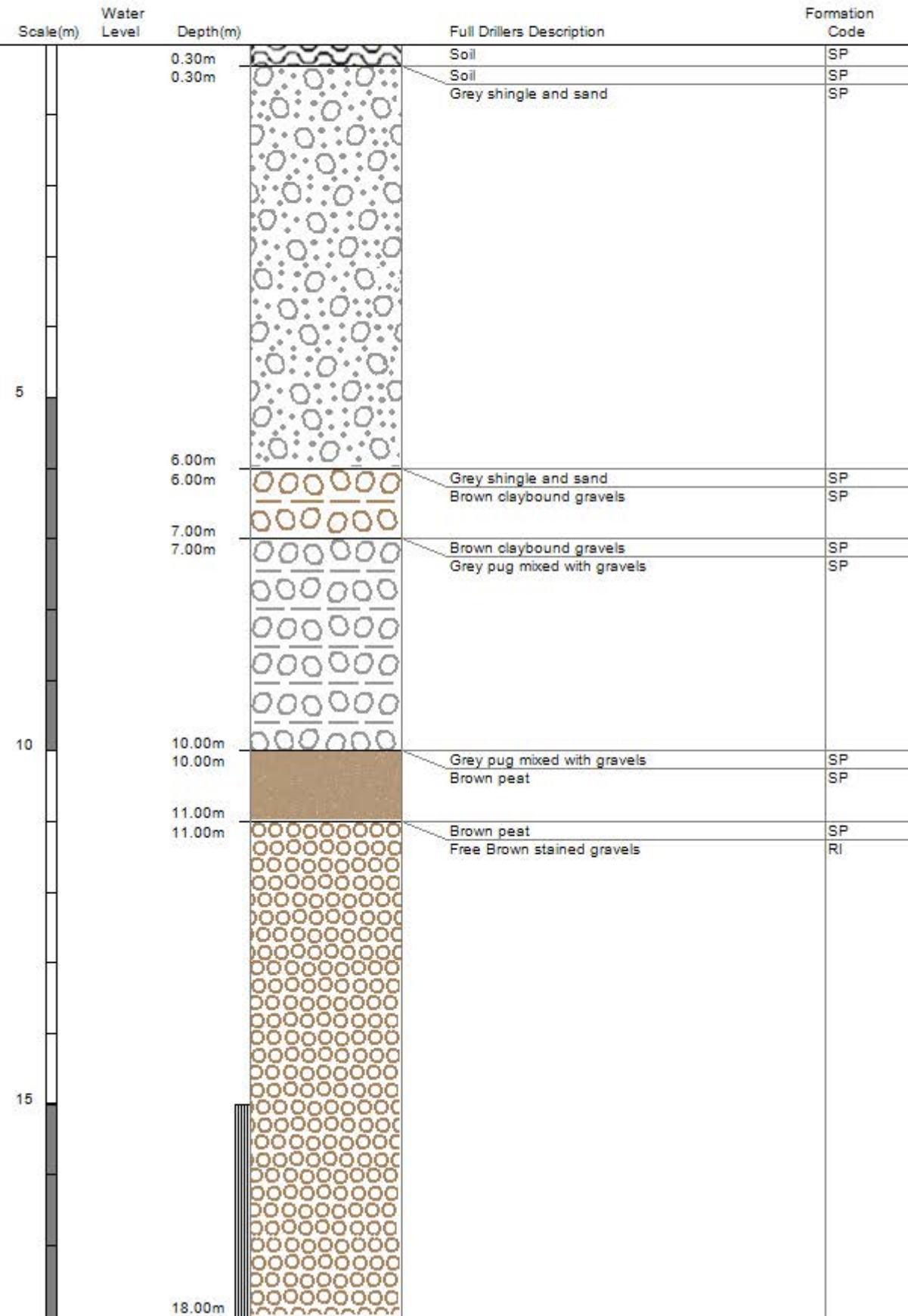
NZGD ID: TP_35583

Water Bore Logs, sourced from Environment Canterbury records

Borelog for well M36/3133

Grid Reference (NZTM): 1560984 mE, 5173110 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 16.1 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Cable Tool
Borelog Depth: 18.0 m Drill Date: 07-Nov-1985

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/5307

Grid Reference (NZTM): 1560645 mE, 5173256 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 18.0 m +MSD Accuracy: < 2.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary Rig
Borelog Depth: 36.0 m Drill Date: 14-Jan-1998

Environment Canterbury Regional Council
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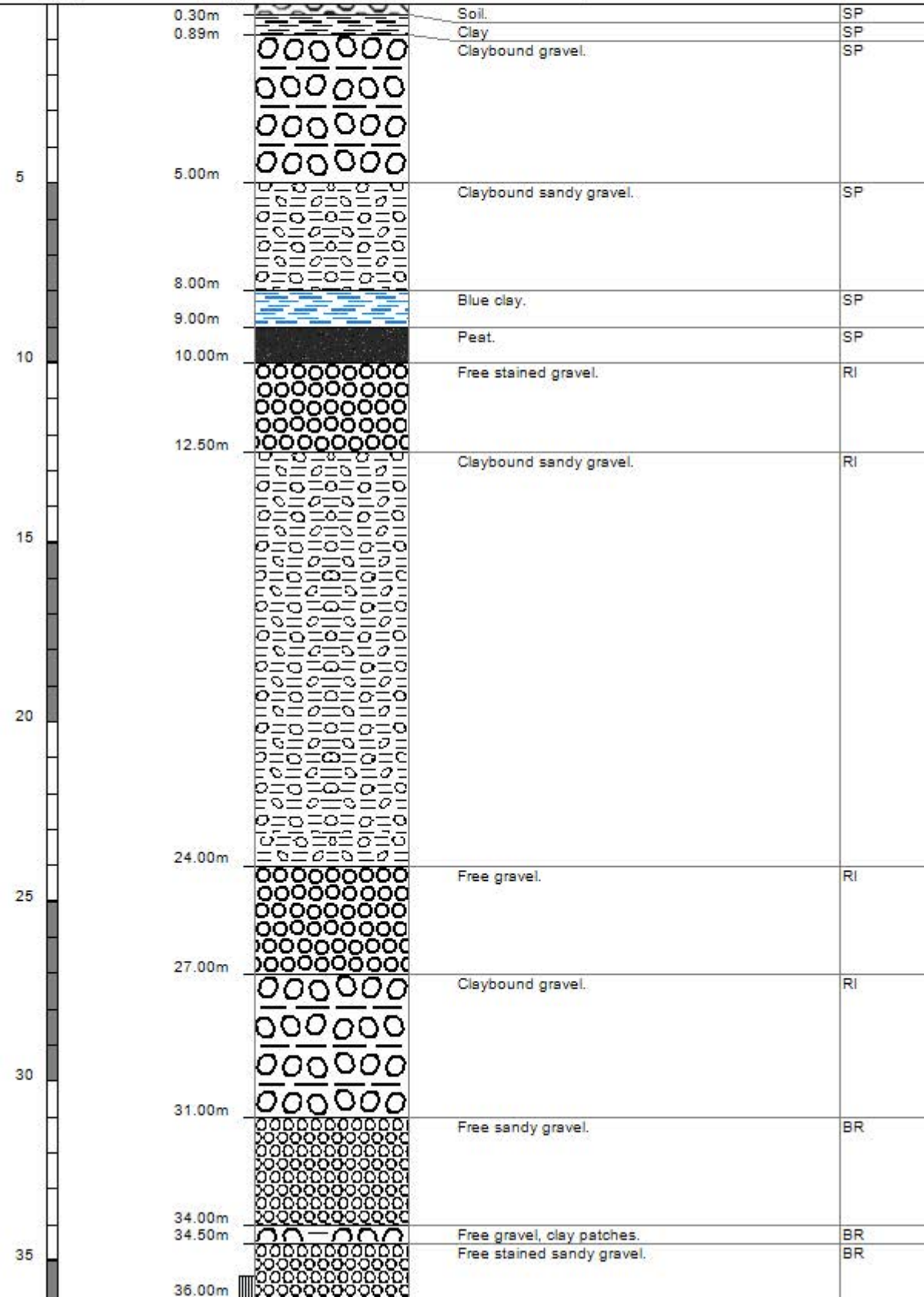

Borelog for well M36/5524

Grid Reference (NZTM): 1560843 mE, 5173323 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 17.1 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Unknown
Borelog Depth: 15.2 m Drill Date: 02-Oct-1998

Environment Canterbury Regional Council
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Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
			Earth	SP
		0.30m		
		0.30m	Earth	SP
			Claybound gravel	SP
		1.20m		
		1.20m	Claybound gravel	SP
			Sandy gravel	SP
		3.00m		
		3.00m	Sandy gravel	SP
			Water-bearing free gravel	SP
		4.80m		
		4.80m	Water-bearing free gravel	SP
5			Water-bearing free Brown stained sandy gravel	SP
		6.19m		
		6.19m	Water-bearing free Brown stained sandy gravel	SP
			Peat	SP
		9.00m		
		9.00m	Peat	SP
			Claybound gravel	RI
		9.50m		
		9.50m	Claybound gravel	RI
10			Water-bearing free lightly stained sandy gravel	RI
15		15.20m		

Borelog for well M36/20546

Grid Reference (NZTM): 1560681 mE, 5172885 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 16.7 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 17.3 m Drill Date: 14-Dec-2010

Environment Canterbury Regional Council
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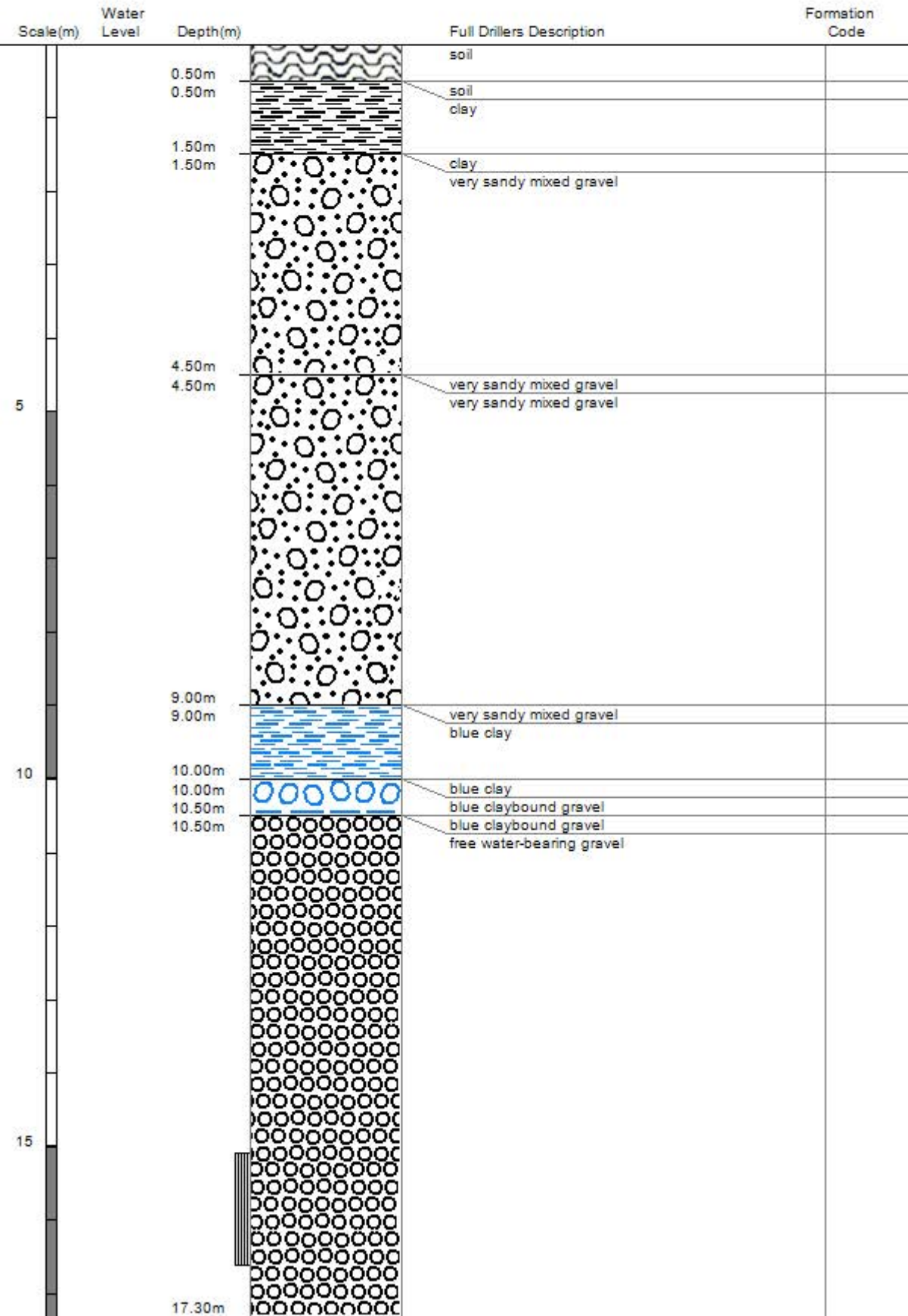

Drawing G00417-02

TRICES ROAD

BIRCHS ROAD

HAMPTONS ROAD

#16

CPT1

H7

M36/5524

H8

CPT2

M36/5307

Lot 1
DP 73583

Lot 2
DP 73583

Lot 1
DP 360577

H6

Pt
RS 2423

Lot 1
DP 4582

Lot 2
DP 5857

Pt
RS 2423

TP7

CPT4

CPT5

H1

H5

Lot 1
DP 78905

H3

M36/3133

TP8

Pt
RS 3122

Lot 1
DP 3896

H2

Lot 2
DP 360577

M36/20546

H4

CPT3

Legend

H1	Approximate location and number of hand augered borehole.
CPT1	Approximate location and number of Cone Penetration Test (CPT), put down under the direction of Fraser Thomas Ltd.
M36/3133	Approximate location and number of existing water bore logs, sourced from Environment Canterbury records.
TP7	Approximate location and number of machine excavated test pit, put down under the direction of other consultants.
	Approximate location and extent of subject site.
	Approximate inferred location and extent of existing stockpiles observed at the time of the Fraser Thomas Ltd investigation (July 2020).

SURVEYED			APPROVED DATE
DESIGNED			MVR
DRAWN	JTG	17/02/2021	
CAD	GS	17/02/2021	
CHECKED			

REVISION	CHANGES	CHECKED	DATE
A	Issued for information	MVR	17/02/21

NOTES

1. This plan has been adopted from Quick map. The location and extent of the site boundaries and site features are therefore considered to be approximate only.

CLIENT

TRICES ROAD REZONING GROUP

PROJECT

TRICES ROAD AREA
PREBBLETON

TITLE

SITE PLAN

Fraser Thomas

ENGINEERS • RESOURCE MANAGERS • SURVEYORS

HIGHBROOK, AUCKLAND 2025
TEL+64-9-278 7078

TARADALE, NAPIER 4141
TEL+64-6-211 2766

RICCARTON, CHRISTCHURCH 8041
TEL+64-3-358 5936

CROMWELL 9342
TEL+64-3-428 3292

SCALE 1:2500 (A3)

DRAWING No G00417-02 REVISION A

SHEET 1 of 1